3GPP TSG RAN WG2 Meeting #123bis R2-230xxxx

**Xiamen, China, October 09-13, 2023**

**Agenda item:** 7.x.x

**Source:** Intel Corporation

**Title:** Outcome of email discussion [Post123bis][310][NR-NTN Enh] UE caps running CR (Intel)

**Document for:** Discussion and decision

# Introduction

This document aims to review the running CRs on UE capabilities for Rel-18 NR NTN Enhancement and to also discuss the open topics, if any.

* [Post123bis][310][NR-NTN Enh] UE caps running CR (Intel)

 Scope: running CR update and list of open issues

 Intended outcome:

* + - * + Endorsed running CRs
				+ List of open issues to be addressed by company Tdocs

 Deadline: Long

For reference, Annex includes RAN2#123bis agreements on this topic. Please provide your inputs **before/by Monday October 23rd 5pm UCT (10am PST)** to have time to update the running CRs and further review/discuss the report and updated CRs (as official email discussion deadline is Friday Oct. 27th 1000 UTC, 2023).

# Companies’ point of contact (PoC)

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| **Company’s name** | **PoC’s name** | **PoC’s email address** |
| Ericsson | Ignacio Pascual | Ignacio.pascual.pelayo@ericsson.com |
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# Discussion

The following was agreed in last RAN2#123bis meeting “*Combination of RACH-less HO with time-based CHO is supported in Rel-18 NTN for both Configured and Dynamic Grant.*”. RAN2 should discuss whether related UE capabilities are desirable.

1. Do you support defining a new UE capability to indicate UE’s support of RACH-less HO with time-based CHO?

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| **Company’s name** | **Yes/No** | **Comments, if any** |
| Ericsson | No  | Existing capabilities, CHO and RACH-less, should be enough. |
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1. If your response to previous Discussion point 1) is yes, do you support having two new UE capabilities to indicate UE’s support differently with CG and DG for the combination of RACH-less HO with time-based CHO?

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| **Company’s name** | **Yes/No** | **Comments, if any** |
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1. Please indicate if you have any suggested change on the TPs provided on UE capability running draftCRs to TS 38.306 and 38.331.

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| **Company’s name** | **TS #** | **Section** | **Comments, if any** |
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1. Please indicate if there are any other UE capabilities that needs to be discussed/defined by RAN2 for Rel-18 NR NTN Enhancements.

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| **Company’s name** | **Comments, if any** |
| Ericsson | * In moving cells, location-based CHO involves the calculation of the present reference location from ephemeris and one reference location at epoch time. Thus, a new capability is needed.
* Unchanged PCI. Separate capabilities for hard and soft switch.
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1. [TBD - To be updated by Rapp. if needed based on companies’ input]

# Conclusion

The proposals captured are the following:

**Proposal 1.** [TBD - To be updated by Rapp. if needed based on companies’ input]

# Annex

## Coverage Enhancements

1. RAN2 continues to focus on a solution to address PUCCH repetition for Msg4 HARQ-ACK in Msg3 only for random access procedure triggered by RRC connection establishment, RRC connection re-establishment or RRC connection resume, i.e. to CCCH/CCCH1 (in the future we can consider random access during RRC connected, depending on RAN1)
2. No explicit NW indication to enable/disable PUCCH repetition for Msg4 HARQ-ACK besides the needed signalling for number of repetition, RSRP configuration in SIB (meaning that if these parameters are signalled, PUCCH repetition for Msg4 HARQ-ACK is enabled)

## Network verified UE location

1. Add in NR-Multi-RTT-SignalMeasurementInformation the measurements relevant to RAN1 agreed offset (e.g., the actual index difference between subframe j and subframe i and the DL timing drift due to Doppler over the service link associated with the UE RX-TX time difference measurement period) with detailed definition referred to RAN1 agreements.
2. Ephemeris and corresponding time information (e.g., epochTime) is not provided by the UE. How this is provided to the LMF is up to RAN3 (can come back to see whether the problem that the UE could use a different ephemeris – and then should report it back to the gNB – is a valid case to consider)
3. RAN2 assumes that FG 44-3 should be an LPP capability to be reported to the LMF (no need for other capabilities)
4. RAN2 understands that to solve the mirror point issue, the measurements reported by RAN should include the information of the cells on the opposite side

## NTN-TN enhancements

1. The maximum number of TN coverage area information is 32 (5 bits)
2. RAN2 will not specify restrictions on TN coverage description (i.e., description of TN coverage is left to NW implementation). The signalled TN coverage can describe areas not currently covered by the satellite cell footprint (FFS how to reflect this in the specification)
3. TN coverage information can be broadcast by both (quasi)earth-fixed and earth-moving cells
4. The working assumption “We do not introduce new triggers making the UE reacquire the TN coverage information from SI” in Rel-18 is confirmed
5. The new SIB including the TN coverage information is not an essential SIB for NTN. An NTN-capable UE does not need to consider the cell barred if it is unable to acquire the SIB when scheduled.
6. Legacy SI update procedure will be used when the network updates the TN coverage information (can further check for moving cell case)

## Handover enhancements

1. For location-based CHO for earth-moving cells, re-use the procedure from cell reselection as baseline to derive the candidate cell’s reference location as the cell moves (FFS on how to signal the needed parameters, e.g. ephemeris and Epoch time)
2. Upon T304 expiry, the UE does not fallback to RACH-based HO.
3. Preallocated UL grant must be configured with an associated RSRP threshold.
4. UE relies on T304 and RRC Re-establishment procedure to address RACH-less HO failure in Rel-18 NTN (as in LTE). No new NTN-specific enhancements are introduced. If TAT expires, the UE follows the legacy procedures, regardless of the RACH-less HO configuration. RAN2 understands that the NW can ensure a proper configuration for TAT and T304 values (up to NW implementation, no need to capture this in the specs).
5. As for RACH-less LTM, for RACH-less NTN, the UE determines successful reception of its first UL data based on receiving a PDCCH addressing the UE’s C-RNTI in the target cell scheduling a new transmission as first UL transmission. Can be either DL assignment or UL grant addressed to same HARQ process for the “new transmission”. RAN understands this does not exclude the possibility to use a Contention Resolution MAC CE but this will not be used as a determination of the RACH less HO completion
6. We follow the LTE baseline for when UE starts the PTAG timeAlignmentTimer in NTN RACH-less HO (option 1 in R2-2311318)
7. Combination of RACH-less HO with time-based CHO is supported in Rel-18 NTN for both Configured and Dynamic Grant. For the Dynamic Grant case this should be configured by the NW only when the is no risk of confusion about which beam to use (up to NW implementation).
8. We don’t consider the impact on Rel-17 UEs behavior (or Rel-18 UEs not supporting unchanged PCI) when defining the Rel-18 unchanged PCI solution
9. Network provides the sync information of target satellite in advance to UE before satellite switching, via broadcast signalling
10. RAN2 confirms satellite switching with unchanged PCI is only applicable on quasi-earth fixed system
11. Only 1 target satellite information (i.e. NTN-config) of serving cell is provided in SIB19. FFS on exact signalling
12. SMTC configuration of target satellite needs further discussion:

      FFS on whether and how to provide the SMTC configuration of target satellite.

      FFS on how to handle the SMTC adjustment.

1. We support soft satellite switching in Rel-18
2. There will be an indication (FFS if explicit or implicit) whether hard switch or soft switch is used.
3. At least soft satellite switching, network provides SSB information of target satellite to UE. FFS on the details: options include e.g. indicating a time offset/information or indicating a different SSB index for the target satellite (FFS for Hard satellite switch)
4. In soft satellite switching, UE can start synchronizing with target satellite before T-service of source satellite.
5. We introduce a T-start which indicates the earliest occasion when the UE can start synchronizing with target satellite (actual signalling is FFS). In soft switch scenario, T-start of target satellite is earlier than T-service of source satellite (FFS if T-start is also used for hard satellite switch)
6. For soft satellite switching, the exact time when the UE starts synchronizing with target satellite (between T-start and T-service) is up to UE implementation
7. UE is not required to connect to source satellite when the UE switches to target satellite.
8. Common signalling (e.g. using servingCellConfigCommon) for the purpose of (C)HO in NTN is not supported in Rel-18.